UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/598,529	06/08/2007	Masahiko Hamanaka	G0126.0248	6957

32172 7590 08/13/2010

DICKSTEIN SHAPIRO LLP
1633 Broadway
NEW YORK, NY 10019

EXAMINER	
KOZIOL, STEPHEN R	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
08/13/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/598,529	HAMANAKA, MASAHIKO	
	Examiner	Art Unit	
	STEPHEN R. KOZIOL	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 September 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/01/2006, 06/11/2007, 01/15/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. This non-final Office action is responsive to Applicant's preliminary amendments filed 10 May 2007. Claims 1-47 are presented for examination. The oath submitted 08 June 2007 and the specification and drawings submitted 01 September 2006 have been considered and are accepted. Claims 1-47 are rejected for the reasons indicated hereinbelow

Information Disclosure Statement

2. The information disclosure statements (IDS) submitted on 01 November 2006, 11 June 2007 and 15 January 2009 are in compliance with the provisions of 37 C.F.R. § 1.97. Accordingly, the IDS have been considered by the examiner.

Priority

3. Acknowledgment is made of Applicant's claim for foreign priority under 35 U.S.C. § 119(a)-(d) of Japanese Patent Application No. 2004-059531 filed 03 March 2004.

Objections – Title & Abstract

4. The Title submitted 01 September 2006 is objected to for not being particularly descriptive of the claimed invention. A more descriptive title, such as "Object pose estimation and comparison using image sharpness differences," or the like, is suggested.

5. The abstract submitted 01 September 2006 is also objected to for minor informalities. One goal of the abstract is to provide a reader with a concise summary of the key elements of the invention such that the reader may quickly determine whether or not the rest of the patent is worth considering; i.e. the abstract should be a stand-alone encapsulation of the invention. Accordingly, the abstract should not refer back to other portions of the specification by incorporating reference numbers to various drawings. Also, the article "an" is repeatedly used

where the article "a" would be more appropriate. Please provide a corrected abstract (e.g. "A pose estimation and comparison system has a[[n]] pose estimation and comparison unit ~~(20)~~…").

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claims 24-29, 32, 35, 38, 41, 44 and 47 are rejected under 35 U.S.C. § 101 as not falling within one of the four statutory categories of invention. Independent claims 24, 28, 32, 38 and 44 each encompass a "program" that causes a computer to implement pose estimation processing. However, there is no disclosed relationship between the claimed programs and the computer, i.e., the program need not be stored or executed on the computer. A program having no disclosed connection to a computer is nonstatutory. Applicant is encouraged to amend each of the independent program claims such that a computer, or non-transitory computer-readable medium, clearly stores and executes the claimed program, e.g.: "A non-transitory computer-readable medium storing a ~~An~~ pose estimation program causing a computer to execute…" Each of the dependent claims are rejected for their dependence on rejected base claims.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Each of similar independent claims 1, 11, 16, 20, 24 and 28 recites the limitation "a plurality of comparison images *close* to the input image" (emphasis added). However, the claim phrase "*close* to the input image" as used across the above-noted independent claims, is a subjective phrase of considerable elasticity whose metes and bounds have not been adequately defined in the claims, or explicitly defined in the specification. I.e., the artisan of ordinary skill, presented with the instant claims, would be unable to determine, with the precision and clarity required by §112 ¶2, whether "close" as claimed refers to, e.g., spatial proximity, feature proximity, etc., or combinations thereof. It is suggested that the claim phrase "close to the input image" be clarified using an objectively-verifiable metric that determines closeness as claimed. Each of the dependent claims are rejected for their dependence on rejected base claims.

Each of similar independent claims 30, 31, 32, 36, 37 and 38 recites the limitation "pose/illumination." However, the metes and bounds of "pose/illumination" cannot be determined from either the claims or the relevant portions of the specification. I.e., the artisan of ordinary skill, presented with the instant claims, would be unable to determine, with the precision and clarity required by §112 ¶2, whether "pose/illumination lose" as claimed refers to, e.g., "pose and illumination," or "pose or illumination" etc. It is suggested that the claim phrase

"pose/illumination" be clarified by inserting either "and" or "or" between pose and illumination. Each of the dependent claims are rejected for their dependence on rejected base claims.

Each of similar independent claims 33, 39, and 45 recites the limitation "the two-dimensional image having the highest similarity." However, there is insufficient antecedent basis for referring back to "*the* two-dimensional image having the highest similarity" since no such image has been established in the claims. It is suggested that independent claims 33, 39 and 45 be amended to recite "*a* two-dimensional image having the highest similarity" Each of the dependent claims are rejected for their dependence on rejected base claims.

Claim 41 recites the limitation of "if the two-dimensional image having the highest similarity in brightness is not *clear*..." However, the metes and bounds of "clear" cannot be determined from either the claim or the relevant portions of the specification. I.e., the artisan of ordinary skill, presented with the instant claims, would be unable to determine, with the precision and clarity required by §112 ¶2, what metrics are being used to define clarity as claimed. It is suggested that "clear" be replaced with "sharp," as found in similar claims 39 and 40.

Any amendment to the claims must be commensurate in scope with the corresponding disclosure.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 1-3, 6-8, 11-13, 16-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishiyama U.S. Pre-Grant Application Publication No. 2003/0035098 ("Ishiyama") in view of Kohmo U.S. Pre-Grant Application Publication No. 2003/0161535 ("Kohmo").

Regarding similar independent claims 1 (system), 11 (system), 16 (method), 20 (method), 24 (program) and 28 (program) Ishiyama teaches a pose estimation system for performing object pose estimation by comparing an input image with a three-dimensional object model *(see Figs. 3-5 and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system)*, the pose estimation system comprising:

i. an pose candidate decision unit for generating at least one pose candidate *(see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed)*;

ii. a comparison image generation unit for generating, according to the generated pose candidate, a plurality of comparison images close to the input image, while projecting the

three-dimensional object model to a two-dimensional image *(see Ishiyama Fig. 3 as described in ¶¶0044-45 where images are projected onto a pose candidate)*;

iii. a difference calculator for calculating a plurality of differences *(see Ishiyama Fig. 3 as described in ¶¶0045-46 where differences between the projected images and the pose candidate are calculated)*; and

iv. a determination unit for selecting a comparison image having the smallest difference among the plurality of differences and estimating an optimal pose based on the selected comparison image (*see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).*

Ishiyama is silent on the system further comprising a first sharpness extraction unit for extracting a first sharpness amount reflecting the sharpness from each of the plurality of comparison images, and a *weighted* difference calculator, as claimed. However, Kohmo teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing *(see Kohmo ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity*).

The ordinarily-skilled artisan, starting with the pose estimation system of Ishiyama, would have appreciated the benefits of using a weighted measure of sharpness to determine pose similarity, as proposed by Kohmo in ¶¶0065-66. The resulting combination of Ishiyama and Kohmo would achieve the predictable and expected benefits of increasing the accuracy of the pose estimation by incorporating a measure of image sharpness. The artisan of ordinary skill would have been motivated to combine Kohmo with Ishiyama, as proposed above, at least

because both Kohmo and Ishiyama are drawn to similar image matching systems, and so the similarities between Kohmo and Ishiyama invite further modifications between the two.

Therefore, a person having ordinary skill in the image processing arts at the time of the invention would have found it obvious to combine the weighted sharpness values of Kohmo, with the pose estimation system of Ishiyama to achieve the well-known and expected benefits of increasing the accuracy of the pose estimation by incorporating a measure of image sharpness.

Regarding similar claims 2 (system), 12 (system), 17 (method), 21 (method), 25 (program) and 29 (program) Ishiyama and Kohmo teach the method as indicted re claim 1 above, but are silent on the method further comprising a second sharpness extraction unit for extracting a second sharpness amount reflecting the sharpness from the input image, wherein the weighted difference calculator calculates a plurality of weighted differences by weighting the difference between the second sharpness amount of the input image and the first sharpness amount of each of the comparison images to the difference between the input image and the comparison image. However, official notice is taken to note that the uses and benefits of using a second sharpness extractor are well known and expected in the image processing arts (and Kohmo already teaches a first sharpness extractor, as indicated re claim 1 above). It would have been obvious to the artisan of ordinary skill at the time of the invention to use the results from a second sharpness extractor within the system of Ishiyama and Kohmo as described re claim 1 above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Regarding similar claims 3 (system), 8 (system), 13 (system), Ishiyama and Kohmo teach the method as indicted re claim 1 above, but are silent on the method further comprising wherein the weight becomes higher as the sharpness of the image becomes higher in the weighted difference calculation. However, official notice is taken to note that the uses and benefits of using a variable weight are well known and expected in the image processing arts (and Kohmo already teaches a weighted first sharpness value, as indicated re claim 1 above). It would have been obvious to the artisan of ordinary skill at the time of the invention to use a variable weighted sharpness result within the system of Ishiyama and Kohmo as described re claim 1 above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Regarding similar claims 6 (system), 7 (system), 26 (program) and 27 (program), Ishiyama and Kohmo teach the method as indicted re claim 1 above, but are silent on the method further comprising wherein the determination unit further performs object comparison by comparing the minimum weighted difference of the estimated optimal pose with a predetermined threshold value. However, official notice is taken to note that the uses and benefits of using a predetermined threshold in pose estimation are well known and expected in the image processing arts. It would have been obvious to the artisan of ordinary skill at the time of the invention to use a predetermined threshold within the system of Ishiyama and Kohmo as described re claim 1 above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Regarding similar claims 18 (method) and 19 (method), Ishiyama further teaches selecting a comparison image having the smallest weighted difference among the plurality of

weighted differences; and estimating an optimal pose based on the selected comparison image *(see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).*

Regarding similar claims 22 (method) and 23 (method), Ishiyama further teaches difference calculation method according to claim 20, further comprising: performing comparison by comparing the plurality of weighted differences obtained by the calculation *(see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).*

Regarding similar independent claims 30 (method), 36 (method) and 42 (method) Ishiyama teaches object pose/illumination estimation method *(see Figs. 3-5 and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system)* for estimating at least one of the pose and the illumination conditions of an object *(see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed)* by generating a two-dimensional image of the object while changing at least one of the pose and the illumination conditions of the object with the use of a three-dimensional model of the object*(see Ishiyama Fig. 3 as described in ¶¶0044-45 where images are projected onto a pose candidate).*

Ishiyama is silent on the system wherein sharpness of the generated two-dimensional image is reflected in the similarity, as claimed. However, Kohmo teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing *(see Kohmo ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image*

similarity). Motivation to combine Ishiyama and Kohmo to achieve the results of claim 30, 36 and 42 can be found re similar claim 1 above.

Regarding similar independent claims 31 (system), 37 (system) and 43 (system) Ishiyama teaches an image generation unit for generating a two-dimensional image of an object *(see Figs. 3-5 and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system)* while changing at least one of the pose and the illumination conditions of the object with the use of a three-dimensional model of the object (*see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed)*; a calculator for calculating the similarity by comparing the generated two-dimensional image with an input image (*see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected)*.

Ishiyama is silent on the system further comprising an extraction unit for extracting sharpness from the generated two-dimensional image and reflecting the extracted sharpness in the calculation; and a determination unit for estimating at least one of the pose and the illumination conditions based on the calculation result of the calculator, as claimed. However, Kohmo teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing *(see Kohmo ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity*). Motivation to combine Ishiyama and Kohmo to achieve the results of claim 31, 37 and 43 can be found re similar claim 1 above.

Regarding similar independent claims 32 (system), 38 (system) and 44 (system) Ishiyama teaches image generation processing for generating a two-dimensional image of the object *(see*

Figs. 3-5 and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system) while changing at least one of the pose and the illumination conditions of the object with the use of a three-dimensional model of the object (*see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed)*; calculation processing for calculating the similarity by comparing the generated two-dimensional image with an input image (*see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected)*.

Ishiyama is silent on the system further comprising extraction processing for extracting sharpness from the generated two-dimensional image, and reflecting the extracted sharpness in the calculation, as claimed. However, Kohmo teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing *(see Kohmo ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity*). Motivation to combine Ishiyama and Kohmo to achieve the results of claim 32, 38 and 44 can be found re similar claim 1 above.

Regarding similar claims 33 (method), 34 (system), 35 (program), 39 (method), 40 (system), 41 (program), 45 (method), 46 (system) and 47 (program), Ishiyama and Kohmo teach a pose estimation system but are silent on the system further comprising wherein, if the two-dimensional image having the highest similarity in brightness is not, sharp the estimation to the input image is not employed. However, official notice is taken to note that the uses and benefits of varying the sharpness estimation based upon similarity are well known and expected in the image processing arts. It would have been obvious to the artisan of ordinary skill at the time of

the invention to vary the sharpness estimation based upon similarity within the system of Ishiyama and Kohmo as described above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Claim Objections

12. Claims 4-5, 9-10, and 14-15 would be allowable if rewritten to overcome the rejection under 35 U.S.C. §101 and 35 U.S.C. §112 ¶2 set forth in this Office action.

13. The following is a statement of reasons for the indication of allowable subject matter: Regarding similar dependent claims 4-5, 9-10, and 14-15 the prior art of record, alone or in combination, fails to fairly teach of suggest the limitations of: wherein the first and second sharpness amounts are defined by a ratio of a number of pixels whose edge intensity is a threshold value or higher to the total number of pixels, a range of brightness values, dispersion of brightness values, or a number of characteristic points, and wherein the first and second sharpness amounts are defined by an edge image or a characteristic point, as recited in the claims

Comment on 35 USC § 101

14. Independent claims 16, 28, 30, 36 and 42 are "process" claims and have been analyzed in light of *Bilski et al v. Kappos* [1], and the relevant guidance [2], [3]. The independent claims are not directed to an abstract idea at least because the independent claims encompasses more than just a statement of concept, and describe a particular solution to the pose estimation problem to be solved. Furthermore, the independent claims tangibly implement the methods, necessarily using image processing equipment. Additionally, the performance of the pose estimation steps is observable (e.g. by observing the similarity between the pose candidate and the comparison images) and verifiable (e.g. by verifying the resulting similarity between the pose candidate and the comparison images).

Also, independent claims 16, 28, 30, 36 and 42 are found to pass at least the machine prong of the machine or transformation test, at least because the method of claims 16, 28, 30, 36 and 42 necessarily requires the use of a particular machine (e.g. a processor) to implement the steps of the method.

Therefore, based upon consideration of all the relevant factors[3] with respect to the claim as a whole, independent claims 16, 28, 30, 36 and 42, and all claims dependent therefrom, are not directed to an abstract idea.

---

[1] See Bilski et al v. Kappos (SCt. 08-964),

[2] See Memorandum to the Examining Corps, Regarding the Supreme Court Decision in Bilski v. Kappos, issued June 28, 2010, available at http://www.uspto.gov/patents/law/exam/memoranda.jsp

[3] See Interim Guidance for Determining Subject Matter Eligibility for Process Claims in View of Bilski v. Kappos, Federal Registrar, Vol. 75, No. 143, issued July 27, 2010

Contact

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steve Koziol:

- phone 571.270.1844, fax 571.270.2844, or e-mail stephen.koziol@uspto.gov.

Typically, the examiner can be reached Monday - Friday 9:00 - 5:30 ET. For e-mail communications, please note MPEP 502.03, which states, in relevant part, "[w]ithout a written authorization by applicant in place, the USPTO will not respond via Internet e-mail to any Internet correspondence which contains information subject to the confidentiality requirement as set forth in 35 U.S.C. § 122." A sample authorization form which may be used by applicant can be found in MPEP 502.03 section II.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached at (571) 272-74 53. Customer Service can be reached at (571) 272-2600. The fax number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Stephen R Koziol/
Examiner, Art Unit 2624
10 August 2010